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August 19, 2004

**FILED VIA ECFS**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 Twelfth Street, S.W.  
Washington, D.C. 20554

Re: WT Docket No. 02-86  
*AirCell, Inc.*  
Summary of *Ex Parte* Communication

Dear Ms. Dortch:

Today, representatives of Cingular Wireless LLC and Verizon Wireless met with Edmond Thomas, Chief of the Office of Engineering and Technology, and James Schlichting and Julius Knapp of that Office, to discuss the pending petition for renewal and expansion of the AirCell waiver. The carriers' representatives in attendance were Brian Fontes of Cingular, Richard Harvey of Verizon Wireless, Sean Haynberg of V-Comm, L.L.C., and the undersigned. Mr. Haynberg made a presentation, a copy of which is attached. At Mr. Thomas's request, the undersigned also provided him by email with references to certain previously filed documents; a copy of that email is also attached.

Respectfully submitted,

WILKINSON BARKER KNAUER, LLP

By: /s/ Michael D Sullivan  
Michael Deuel Sullivan

Attachment

cc: Michele Farquhar, Esq.



# AirCell System Compatibility Tests

Sean Haynberg

August 19, 2004

# Introduction & Overview

- Background
  - AirCell requests permanent expanded waiver to allow its air-to-ground operations to utilize analog *and digital* cellular spectrum
  - Cellular carriers concerned, contracted V-COMM to conduct compatibility studies
- Overview of V-COMM's tests
  - Flight tests with AirCell phones and base stations
  - Interference compatibility tests with analog & digital cellular networks
  - Cellular spectrum noise studies
- Overview of AirCell's flawed and limited tests
- Conclusions

# Companies Involved in Our Tests

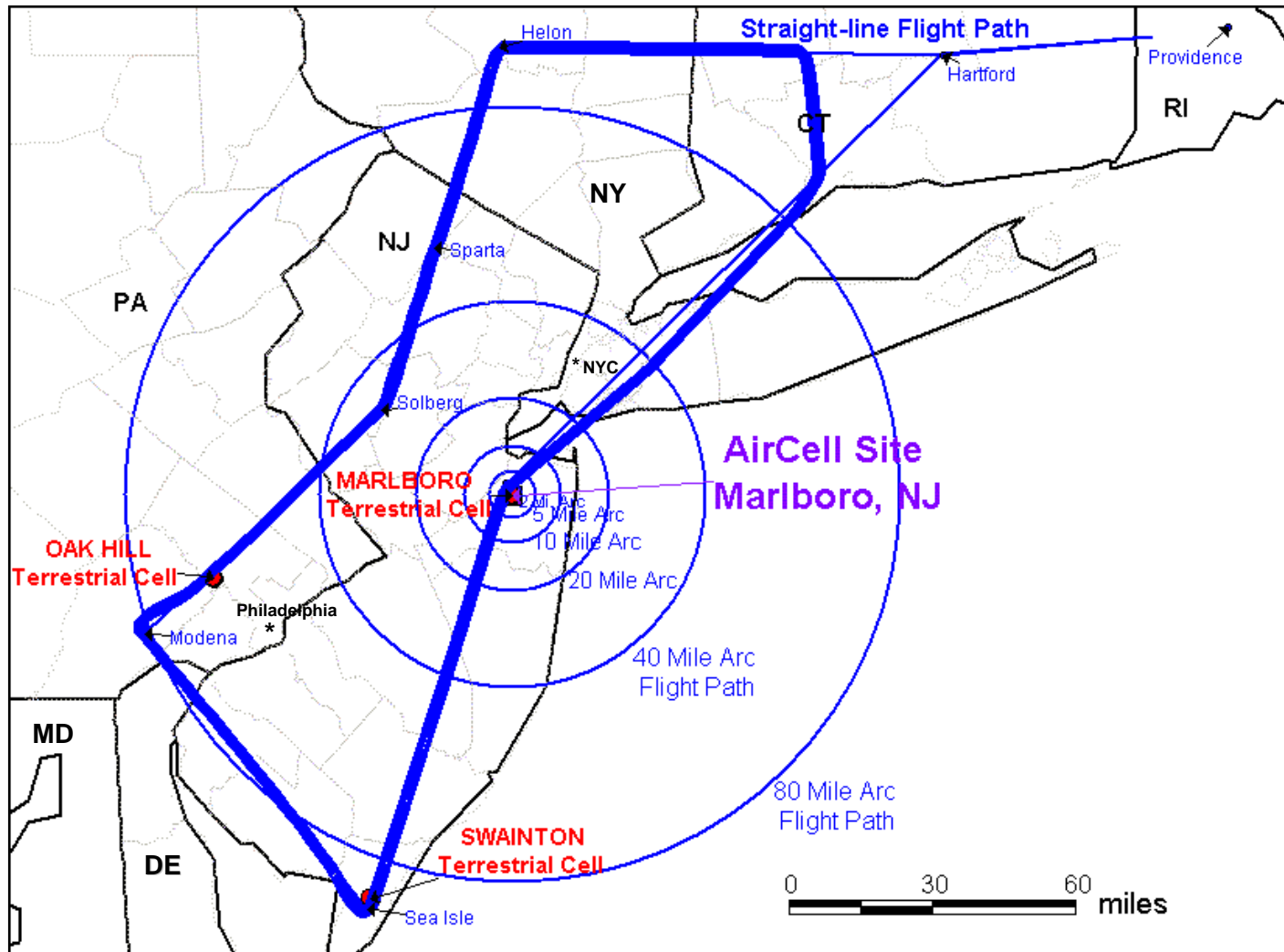
- V-COMM
  - Served as independent engineering firm to perform tests and document findings
  - Executed tests at AirCell sites, coordinated with Lucent, AirCell, and FAA
- Lucent Technologies (manufacturer of cell equipment)
  - Provided insight to tests, methods, interpretation of data
- Cingular, AWS & Verizon Wireless (Service Providers)
  - Facilitated access to cell site equipment in cellular markets
- AirCell
  - Optimized & configured base stations for our flight tests
  - Inspected and verified aircraft AirCell phone installation

# Overview of V-COMM's Flight Tests

- Flight Patterns were typical and representative
  - Used standard FAA VOR stations as roadways in the sky
  - Typical for commercial and general aviation airplanes
  - FAA coordinated and approved
- Utilized standard AirCell base station antenna - configured & verified by AirCell - typical service range (80-90 miles)
- Utilized standard AirCell phone equipment - inspected & verified by AirCell - installed at its authorized installation facilities
- All co-channels and adjacent channels were cleared from area, to ensure measurement of AirCell signals

# V-COMM's Flight Map

(Used standard FAA VOR stations as roadways in the sky)



# Overview of V-COMM's Flight Tests (Cont.)

- Our flight tests include significantly more data than AirCell's 1997 flight tests:
  - 10,000 air miles – using variety of altitudes & aircraft orientations (1997 tests only included 850 miles with 1 aircraft orientation; the best case)
  - Seven terrestrial antennas (incl. Vertical, Horizontal & Slant 45)
  - Two types of aircraft antennas (1997 tests only use VOR type)
- Utilized tests without Dynamic Power Control
  - Captures full impact of interference potential (which includes worst case)
  - Quantify path loss from airplane to terrestrial cellular site
- Utilized tests with Dynamic Power Control
  - Captures the typical airborne unit transmit power levels

# Results of V-COMM's Flight Tests

- AirCell signals received at victim terrestrial sites ...
  - As high as -72 dBm; frequently in -90 to -100 dBm range; often *well above* -110 dBm level
  - Clear evidence of Harmful Interference (*even exceeds -110 dBm level used as an example of harmful interference in FCC's Order on Remand*)
- AirCell units transmit at maximum power level ...
  - Control channels ALL the time
  - Voice channels for a significant portion of time (up to 44%)
  - Since AirCell sites are typically located in rural markets, airborne units transmit at higher power levels over suburban and urban areas



# Measurements of Actual AirCell Customer Calls Agree with Our Flight Test Results

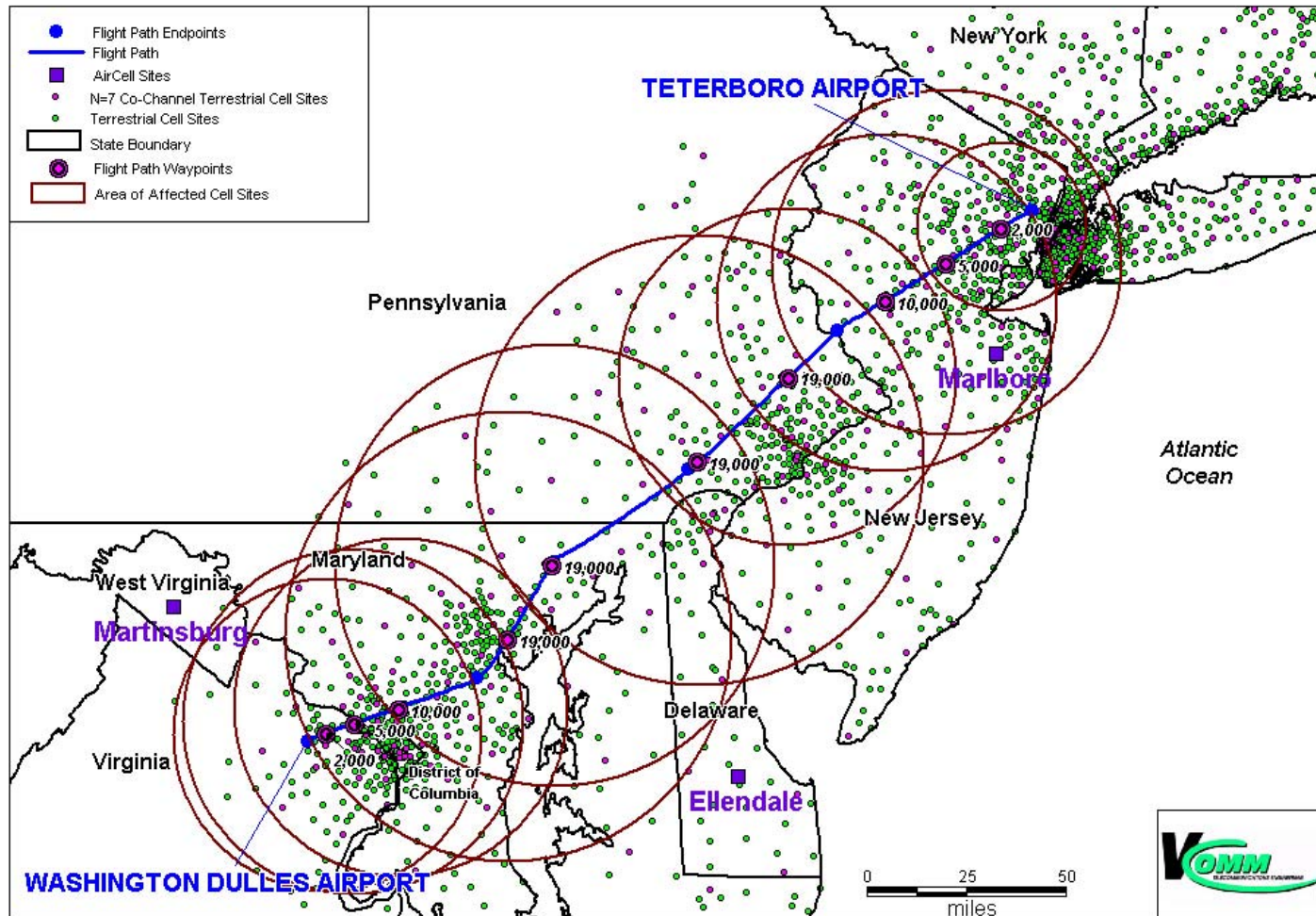
- At FCC's request of 12/18/03, V-COMM measured actual AirCell customers' calls
  - Collected data from 5 AirCell sites, for 33 days, 98 calls, 134 minutes of customer call data
- Power levels from actual customers calls were consistent with V-COMM's flight test results
- AirCell did not provide any data of actual customer calls

# Overview of Case Study

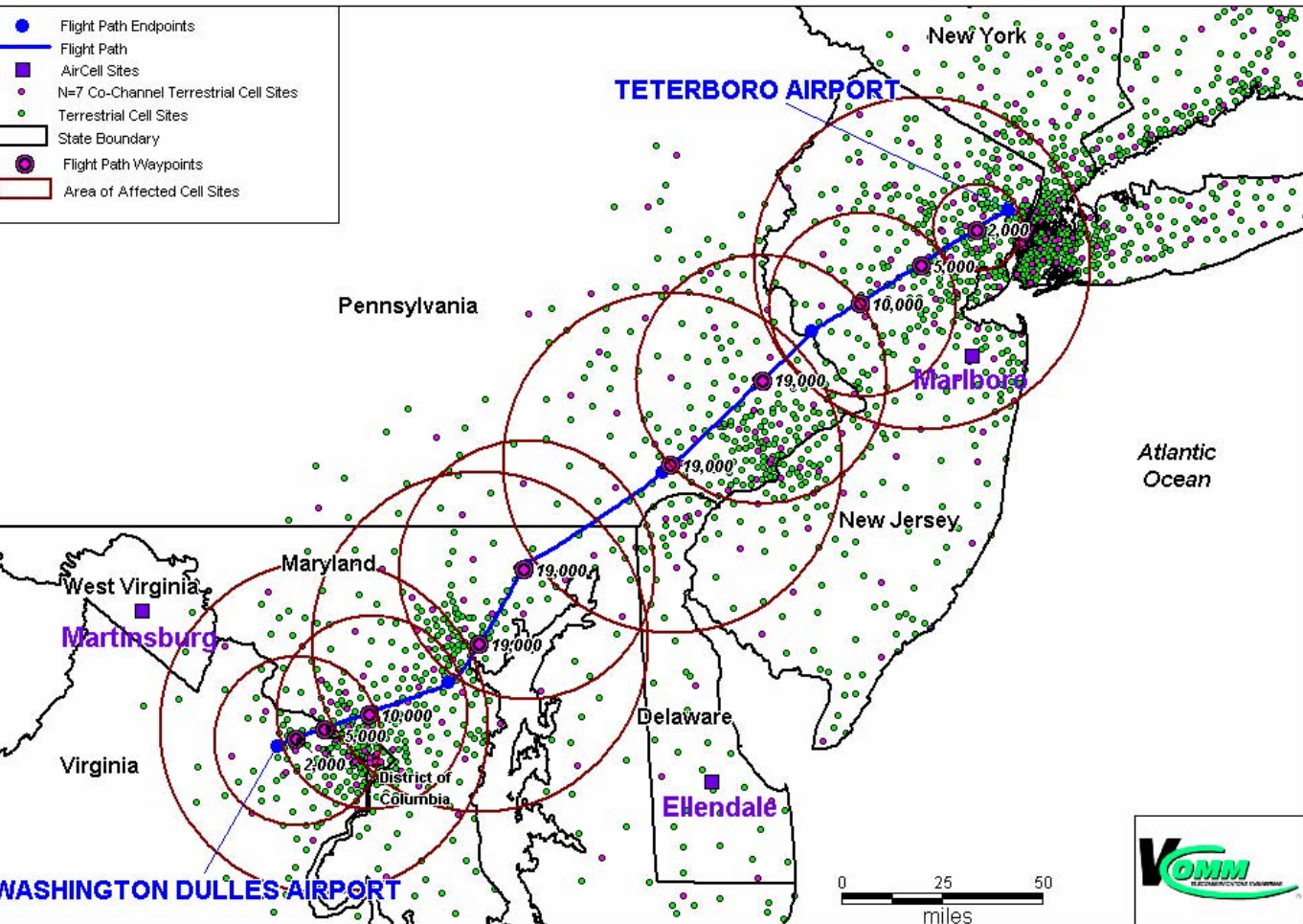
- Used a case study to quantify the impact of AirCell's system on terrestrial cellular networks
- Used a high-traffic air corridor and flight route, (Wash, DC to NY metro route; >113 flights per day)
- Used results from flight tests & interference tests
  - Flight test results - airborne unit transmit power levels, & path loss components
  - Interference test results - shows harmful interference to cellular network at -114 dBm (for analog and digital technologies)
- Shows harmful interference to as many as 30,000 terrestrial calls from 1 AirCell call on 1 flight
- Radius of harmful interference to cellular network extends out to 56 miles from aircraft using an AirCell phone

# Case Study Flight Route

Jet Aircraft Flight Profile & Affected Terrestrial Cell Sites, 90% Signal, **IAP -114 dBm**  
SL45 Antenna, Washington Dulles to Teterboro, NJ Airport



Jet Aircraft Flight Profile & Affected Terrestrial Cell Sites, 90% Signal, **IAP -110 dBm**  
SL45 Antenna, Washington Dulles to Teterboro, NJ Airport



# AirCell's Criticisms of Case Study & Flight Tests

- Claims its million-mile database & internally used model shows no interference
  - *However, it does not provide its million-mile database, nor its model, to the Commission*
- Claims handoffs were not used in the Case Study
  - *This is incorrect - handoffs were used*
- Claims its antennas were lowered into the trees
  - *Independent contractor verified antennas used in testing were not obstructed by tree line*

# Our Interference Compatibility Tests with Analog and Digital Cellular Technologies

- Used terrestrial cellular base stations with standard & typical configurations
  - Tested a typical suburban area (1.5 mile cell coverage radius, conservative-case impact assessed)
  - Tested with actual cellular traffic & noise conditions, consistent roads driven, yielded repeatable results
  - Included 10 Performance Metrics to assess full impact
- AirCell signals cause *significant* harmful interference to analog and digital cellular networks at -114 dBm
  - Results in blocked calls, obstructed cellular service, degraded voice quality, decreased battery life
  - Greater interference will occur under other conditions (e.g. in-building use, E911, tower-top LNA, urban canyons, rural areas)

# Results of Interference Compatibility Tests

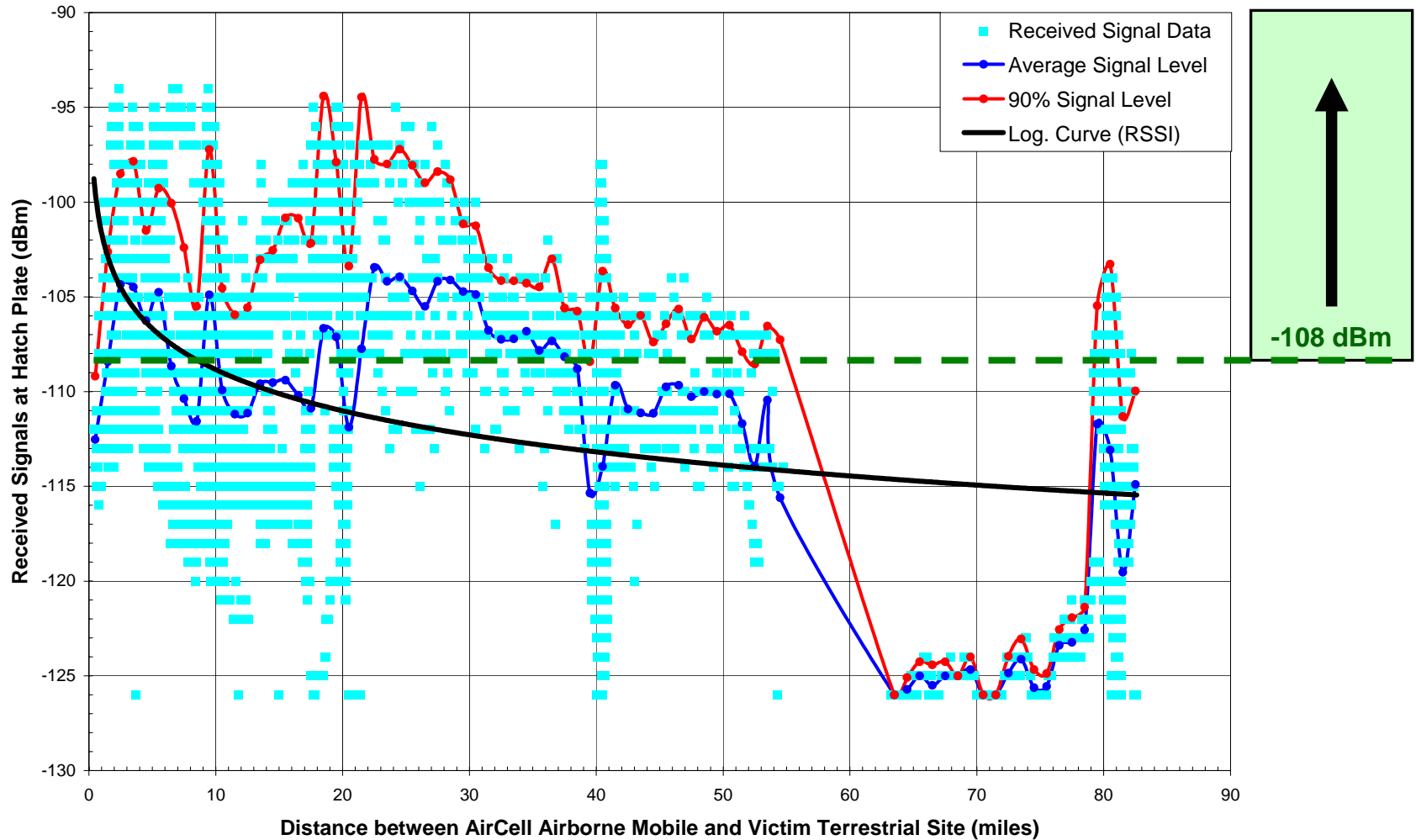
Table 4.5-A Phase 2 Test Results – Summary Results Table

Injected Interfering Signal Level	AMPS Tests – Effects to System Performance	TDMA Tests – Effects to System Performance	CDMA Tests – Effects to System Performance
Baseline, with no injected interference	Reference Level	Reference Level	Reference Level
-126 dBm	“No effect”	“No effect”	“No effect”
-123 dBm	C/I 4 dB dec.	“No effect”	“No effect”
-120 dBm	C/I 7 dB dec. MOS 0.1 dec.	C/I 3 dB dec. BER 0.2% inc.	Tx Pwr 1.6 dB inc.
-117 dBm	C/I 9 dB dec. MOS 0.2 dec.	C/I 5 dB dec. BER 0.5% inc.	Tx Pwr 1.7 dB inc.
-114 dBm	C/I 12 dB dec. MOS 0.2 dec.	C/I 10 dB dec. BER 1.1% inc. MOS 0.3 dec. Blocked Calls 4% Capacity Loss 7%	Tx Pwr 3.1 dB inc.
-111 dBm	C/I 16 dB dec. MOS 0.4 dec.	C/I 11 dB dec. BER 1.8% inc. MOS 0.4 dec. Blocked Calls 7% Capacity Loss 8%	Tx Pwr 3.5 dB inc. Blocked Calls 11%
-108 dBm	C/I 17 dB dec. MOS 0.7 dec. Dropped Calls 4% Capacity Loss 5%	C/I 12 dB dec. BER 1.7% inc. MOS 0.2 dec. Blocked Calls 28% Dropped Calls 50% Capacity Loss 30%	Tx Pwr 3.8 dB inc. Blocked Calls 33% Overflowed Calls 33% Capacity Loss 33%

# Flight Test Results at 20,000 Feet Altitude

## Phase 1 Test Results - AirCell Signals Received at Terrestrial Cell Site

SL45 Antenna, Flight Altitude 20,000 ft, AirCell DPC Disabled (Fixed Pwr, DPC 2), Jet Aircraft





# Cellular Spectrum Noise Floor Studies

- Our studies indicate very low noise conditions existing in terrestrial cellular markets – contradicts AirCell's claims
  - Typically at -127 dBm (allowing quality AMPS calls to -110 dBm)
  - Results agree with AirCell's *actual* noise measurements
  - Measurements and results confirmed by Lucent
- AirCell focuses on *highest peak* noise level; not the typical noise level for the majority of the day
  - Peak level is *not* statistically significant (<0.1% time, 3 seconds per hour) - typical or median level should be used for consideration of secondary services
- AirCell *misunderstands* how practical wireless systems operate
  - Incorrectly asserts that 100% of calls must be 17 dB above the *highest peak* noise level, 100% of time (this is *highly impractical*)
  - Absurdly asserts cellular phones must increase power by 22 dB (Cell phones at full power; impossible to power up to 95 W ERP)

# AirCell's Noise Measurements Submitted in Record

Figure 7.8 Madill, Reverse Channel Noise Floor Histogram (24 Hours)

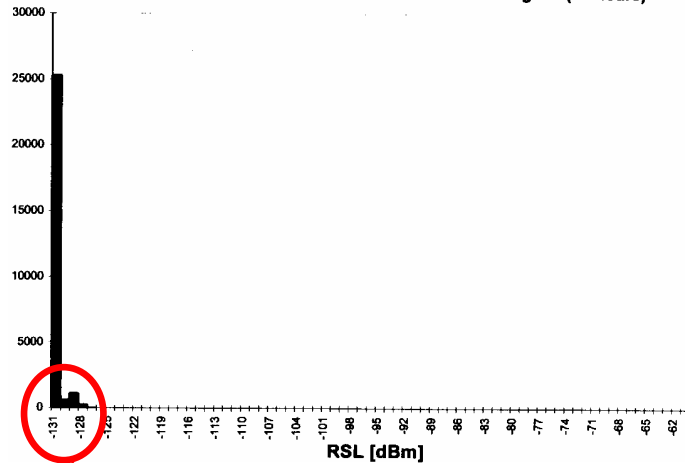
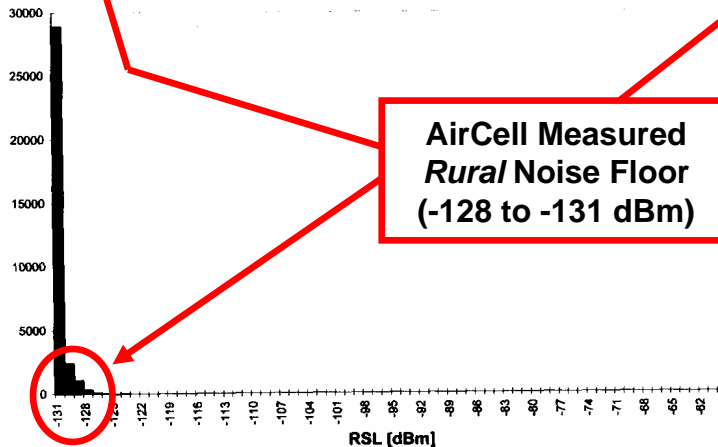
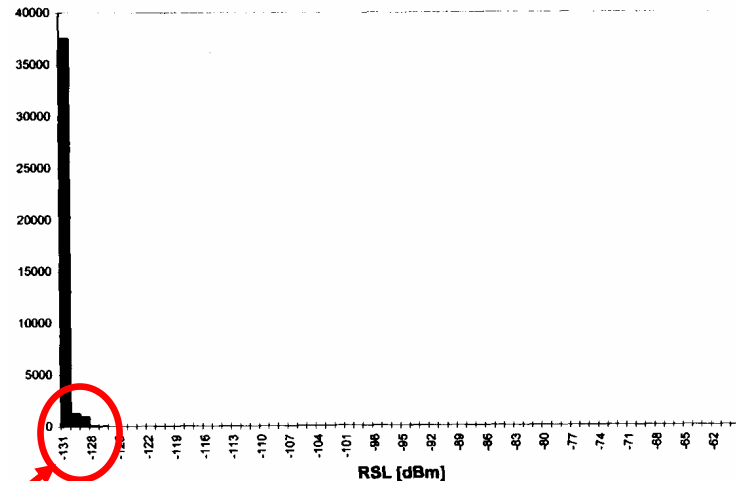


Figure 7.11 - Wichita Falls, Reverse Link Channel Noise Floor Histogram (24 Hours)



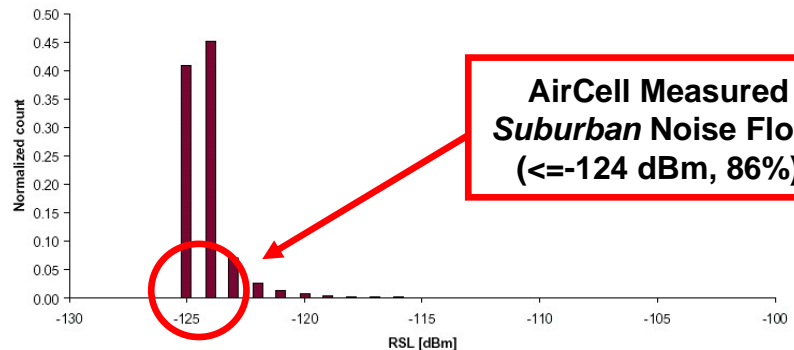
**AirCell Measured  
Rural Noise Floor  
(-128 to -131 dBm)**

Figure 7.9 Waurika Reverse Channel Noise Floor Histogram (24 Hours)



Tulsa TDMA Noise plus Interference Measurement

All channels TDMA  
Mean: -124.03dBm, Std: 1.7dB, Count: 91958

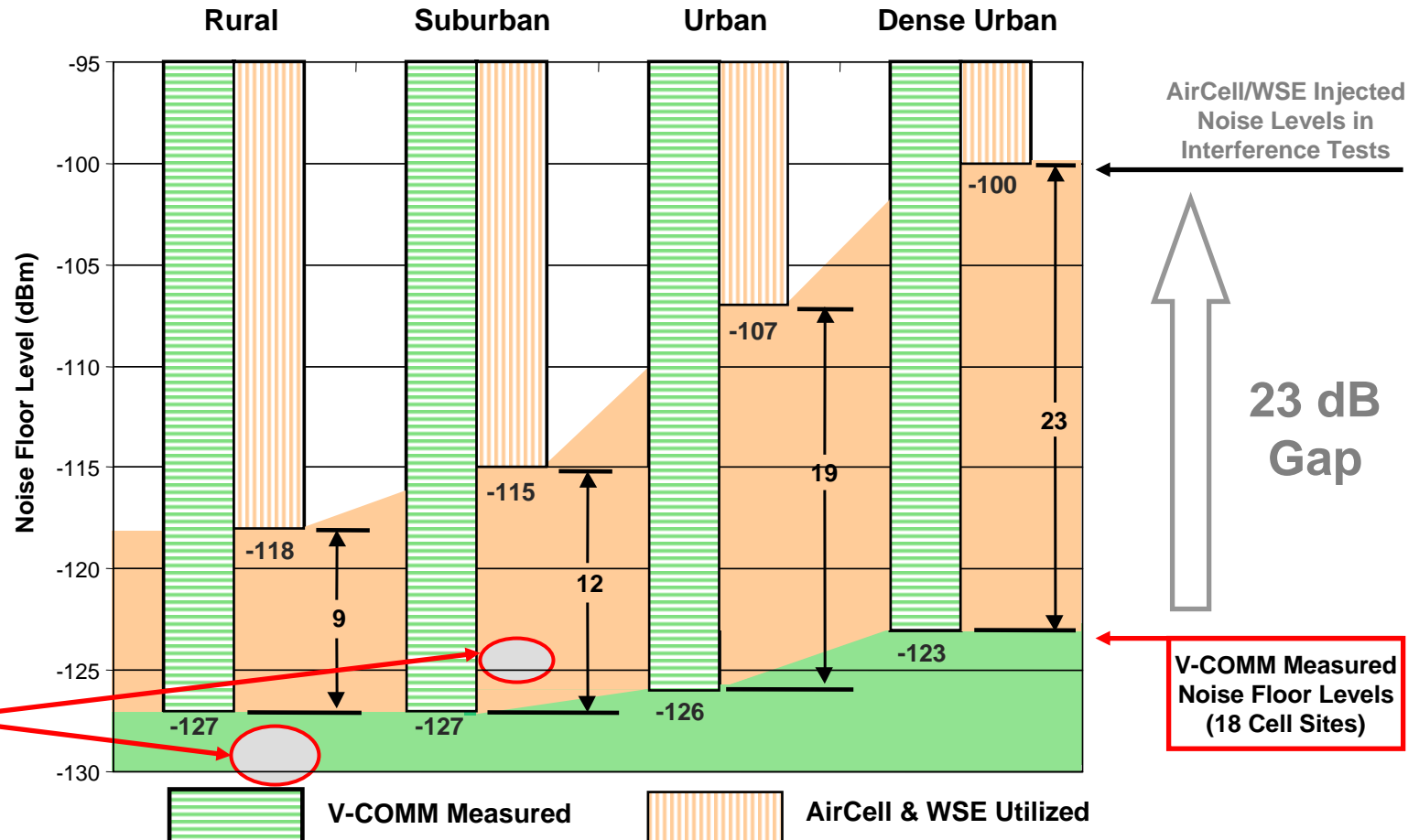


**AirCell Measured  
Suburban Noise Floor  
( $\leq -124$  dBm, 86%)**

Figure 2.6.c.2

# Comparison of Noise Level Measurements

V-COMM vs. AirCell Terrestrial Noise Floor Levels



# AirCell's Tests are Flawed and Inconclusive

- AirCell's flight tests are extremely limited
  - 1997 flight tests included *only* the best-case scenario
  - AirCell did not provide its million-mile database, but only relies upon this best case scenario
- AirCell's interference compatibility tests with digital cellular technologies are flawed, and not representative of impacts to real-world cellular networks
  - Did not perform real-world tests, instead used artificial test conditions with laboratory-like setup (no signal fading, antenna diversity, CDMA soft handoff, or other effects)
  - Injected abnormally high noise levels that masks the effects of the AirCell interference



# AirCell's Injected Noise Invalidates its Interference Tests with Digital Cellular Technologies

- Tests are not representative of the impacts to real-world cellular networks
  - Corrupted its baseline test data – did not use comparisons to typical cellular operating conditions
  - Only represents the impacts to a highly distorted cellular operating network – that does not exist in the real-world

# Conclusion

- AirCell's operation causes harmful interference and other serious degradations to analog & digital cellular networks
  - Loss in coverage for in-building users, urban canyons, suburban and rural areas
  - Loss in capacity due to added interference to CDMA and channel blockage to GSM & TDMA cellular networks
  - Deterioration in voice quality; degrades service quality
  - Decreases cellular users' battery life
  - Interferes with E911 location
  - Reduces throughput for broadband data users

# Other Conclusions

- AirCell's dynamic power control is ineffective in controlling interference
  - AirCell operates at highest power over major markets
- AirCell's horizontal antenna polarization is ineffective in controlling interference
  - Original waiver premised upon cellular systems using only vertical antenna polarization – rule outdated now
  - AirCell signals now increased by a factor of 20
- Therefore, AirCell's waiver should not be extended



From: Sullivan, Michael  
Sent: Thursday, August 19, 2004 4:25 PM  
To: 'julius.knapp@fcc.gov'; 'ed.thomas@fcc.gov';  
'james.schlichting@fcc.gov'  
Subject: FW: Documents re AirCell discussed in today's meeting

(I am resending this due to incorrect email addresses when first sent.)

At today's meeting, I promised to send electronic copies of certain filings from the AirCell proceeding containing detailed test results. In light of the considerable size of these documents, I am instead providing the URLs by which the documents can be downloaded from ECFS.

The Comments in Opposition filed by AT&T Wireless, Cingular Wireless, and Verizon Wireless are available at:

<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513882996](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513882996)>. The V-Comm report was submitted as an attachment to that filing, in several parts: Exhibit I,  
<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513882997](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513882997)>,  
<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513882998](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513882998)>, Exhibit II (body),  
<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513882999](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513882999)>, Exhibit II (attachments),  
<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513883000](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513883000)>, and Exhibit III,  
<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513883001](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513883001)>.

A copy of this email will be submitted as an attachment to the ex parte notice filing concerning today's meeting.

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